B. Claims

The following is a complete listing of the claims, and replaces all earlier versions and listings.

1. (Currently Amended) A method for manufacturing a minute structure, comprising:

providing a first layer including a polymethyl ~~a step of forming an ionizing radiation decomposing type positive type resist layer including a methyl~~ isopropenyl ketone ~~as a first positive type photosensitive material layer to be sensitized by an ionizing radiation of a first wavelength range~~;

providing, on the first layer, a second ~~a step of forming an ionizing radiation decomposing type positive type resist~~ layer including a photosensitive material of a copolymer obtained by [[the]] copolymerization of ~~an ester~~ a methacrylate and a methacrylic acid, with [[the]] a weight average molecular weight of the copolymer of 50,000 to 300,000 and [[the]] a ratio of the methacrylic acid included in the copolymer of 5 to 30% by weight ~~as a second positive type photosensitive material layer to be sensitized by an ionizing radiation of a second wavelength range on the first positive type photosensitive material layer~~;

~~a step of~~ forming a desired pattern from the ~~in the above-mentioned~~ second ~~positive type photosensitive material~~ layer ~~as the an upper layer~~ by exposing a part of the ~~decomposing reaction only in the desired area of the above-mentioned~~ second ~~positive type photosensitive material~~ layer, ~~without decomposing reaction of the above-mentioned first positive type photosensitive material layer by directing an ionizing radiation of the above-~~

~~mentioned second wavelength range via a mask to the substrate surface with the first and second positive type photosensitive material layers formed, and development~~ and removing an exposed part of the second layer using a developing solution~~, and then~~; and

~~a step of~~ forming a desired pattern ~~in the above-mentioned~~ from the first ~~positive type photosensitive material~~ layer ~~as the lower layer~~ by exposing a part of ~~decomposing reaction of a predetermined area of at least~~ the ~~above-mentioned~~ first ~~positive type photosensitive material~~ layer, and removing an exposed part ~~by direction an ionizing radiation~~ of the ~~above-mentioned~~ first layer using a developing solution ~~wavelength range via a mask to the substrate surface with the first and second positive type photosensitive material layers formed, and development, successively; characterized in that a pattern of a convex shape is manufactured in the substrate by executing the above-mentioned steps~~.

2. (Currently Amended) A method for manufacturing a minute structure, comprising:

providing a first layer including a polymethyl ~~a step of forming an ionizing radiation decomposing type positive type resist layer including a methyl~~ isopropenyl ketone ~~as a first positive type photosensitive material layer to be sensitized by an ionizing radiation of a first wavelength range~~;

providing, on the first layer, a second layer including ~~a step of forming an ionizing radiation decomposing type positive type resist layer~~ including a photosensitive material of a copolymer obtained by [[the]] copolymerization of ~~an ester~~ a methacrylate and a methacrylic anhydride, with [[the]] a weight average molecular weight of the

copolymer of 10,000 to 100,000 and [[the]] a ratio of the methacrylic anhydride included in the copolymer of 5 to 30% by weight ~~as a second positive type photosensitive material layer to be sensitized by an ionizing radiation of a second wavelength range on the first positive type photosensitive material layer~~;

~~a step of~~ forming a desired pattern ~~in the above-mentioned~~ from the second ~~positive type photosensitive material~~ layer ~~as the upper layer~~ by exposing a part of the second layer, and removing an exposed part of the second layer ~~decomposing reaction only in the desired area of the above-mentioned second positive type photosensitive material layer without~~ a ~~decomposing reaction of the above-mentioned first positive type photosensitive material layer by directing an ionizing radiation of the above-mentioned second wavelength range via a mask to the substrate surface with the first and second positive type photosensitive material layers formed, and development~~ using a developing solution~~, and then~~; and

~~a step of~~ forming a desired pattern ~~in the above-mentioned~~ from the first ~~positive type photosensitive material~~ layer ~~as the lower layer~~ by exposing a part of the first layer, and removing an exposed part of the first layer using a developing solution ~~decomposing reaction of a predetermined area of at least the above-mentioned first positive type photosensitive material layer by direction an ionizing radiation of the above-mentioned first wavelength range via a mask to the substrate surface with the first and second positive type photosensitive material layers formed, and development, successively; characterized in that a pattern of a convex shape is manufactured in the substrate by executing the above-mentioned steps~~.

3. (Cancelled)

4. (Currently Amended) A method for manufacturing a liquid discharge head comprising a passage for a liquid, which communicates with a discharge port for discharging the liquid, on a substrate with a liquid discharge energy generating element for generating energy used for discharging the liquid, the method comprising ~~step of forming a mold pattern with a removable resin in a liquid flow path forming portion on a substrate with a liquid discharge energy generating element formed, applying and hardening a coating resin layer on the above-mentioned substrate so as to coat the mold pattern, and dissolving and removing the above-mentioned mold pattern so as to form a liquid flow pat, characterized in that the step of forming a mold pattern comprises~~:

providing a first layer including a polymethyl isopropenyl ketone on the substrate;

providing, on the first layer, a second layer including a photosensitive material of a copolymer obtained by copolymerization of a methacrylate and a methacrylic acid, with a weight average molecular weight of the copolymer of 50,000 to 300,000 and a ratio of the methacrylic acid included in the copolymer of 5 to 30% by weight;

forming a second part of a mold of the passage from the second layer by exposing a part of the second layer, and removing an exposed part of the second layer using a developing solution;

forming a first part of the mold of the passage from the first layer by exposing a part of the first layer, and removing an exposed part of the first layer using a developing solution;

providing a coating layer to coat the mold; and

removing the mold to form the passage

~~a step of forming an ionizing radiation decomposing type positive type resist layer including a methyl isopropenyl ketone as the first positive type photosensitive material layer to be sensitized by an ionizing radiation beam of the first wavelength range on the substrate; a step of forming an ionizing radiation decomposing type positive type resist layer including a photosensitive material of a copolymer obtained by the copolymerization of an ester methacrylate and a methacrylic acid, with the weight average molecular weight of the copolymer of 50,000 to 300,000 and the ratio of the methacrylic acid included in the copolymer of 5 to 30% by weight as a second positive type photosensitive material layer to be sensitized by an ionizing radiation of a second wavelength range on the first positive type photosensitive material layer; a step of forming a desired pattern in the above-mentioned second positive type photosensitive material layer as the upper layer by decomposing reaction only in the desired area of the above-mentioned second positive type photosensitive material layer without a decomposing reaction of the above-mentioned first positive type photosensitive material layer by directing an ionizing radiation of the above-mentioned second wavelength range via a mask to the substrate surface with the first and second positive type photosensitive material layers formed, and development using a developing solution; and a step of forming a desired pattern in the~~

~~above-mentioned first positive type photosensitive material layer as the lower layer by decomposing reaction of a predetermined area of at least the above-mentioned first positive type photosensitive material layer by direction an ionizing radiation of the above-mentioned first wavelength range via a mask to the substrate surface with the first and second positive type photosensitive material layers formed, and development, successively.~~

5. (Currently Amended) A method for manufacturing a liquid discharge head comprising a passage of a liquid, which communicates with a discharge port for discharging the liquid, on a substrate with a liquid discharge energy generating element for generating energy used for discharging the liquid, the method comprising ~~step of forming a mold pattern with a removable resin in a liquid flow path forming portion on a substrate with a liquid discharge energy generating element formed, applying and hardening a coating resin layer on the above-mentioned substrate so as to coat the mold pattern, and dissolving and removing the above-mentioned mold pattern so as to form a liquid flow pat, characterized in that the above-mentioned step of forming a mold pattern comprises:~~

providing a first layer including a polymethyl isopropenyl ketone;

providing, on the first layer, a second layer including a photosensitive material of a copolymer obtained by copolymerization of a methacrylate and a methacrylic anhydride, with a weight average molecular weight of the copolymer of 10,000 to 100,000 and a ratio of the methacrylic anhydride included in the copolymer of 5 to 30% by weight;

forming a second part of a mold of the passage from the second layer by exposing a part of the second layer, and removing an exposed part of the second layer using a developing solution;

forming a first part of the mold of the passage from the first layer by exposing a part of the first layer, and removing an exposed part of the first layer using a developing solution;

providing a coating layer to coat the mold; and

removing the mold to form the passage

~~a step of forming an ionizing radiation decomposing type positive type resist layer including a methyl isopropenyl ketone as the first positive type photosensitive material layer to be sensitized by an ionizing radiation beam of the first wavelength range on the substrate, a step of forming an ionizing radiation decomposing type positive type resist layer including a photosensitive material of a copolymer obtained by the copolymerization of an ester methacrylate and a methacrylic anhydride, with the weight average molecular weight of the copolymer of 10,000 to 100,000 and the ratio of the methacrylic anhydride included in the copolymer of 5 to 30% by weight as a second positive type photosensitive material layer to be sensitized by an ionizing radiation of a second wavelength range on the first positive type photosensitive material layer, a step of forming a desired pattern in the above-mentioned second positive type photosensitive material layer as the upper layer by decomposing reaction only in the desired area of the above-mentioned second positive type photosensitive material layer without decomposing reaction of the above-mentioned first positive type photosensitive material layer by~~

~~directing an ionizing radiation of the above-mentioned second wavelength range via a mask to the substrate surface with the first and second positive type photosensitive material layers formed, and development using a developing solution; and a step of forming a desired pattern in the above-mentioned first positive type photosensitive material layer as the lower layer by decomposing reaction of a predetermined area of at least the above-mentioned first positive type photosensitive material layer by direction an ionizing radiation of the above-mentioned first wavelength range via a mask to the substrate surface with the first and second positive type photosensitive material layers formed, and development, successively~~.

6-8. (Cancelled)

9. (Previously Presented) The method for manufacturing a liquid discharge head according to claim 4, wherein [[the]] a first wavelength of light used to ~~expose range for sensitizing~~ the first ~~positive type photosensitive material~~ layer is in a 270 nm to 350 nm range, and [[the]] a second wavelength of light used to ~~expose range for sensitizing~~ the second ~~positive type photosensitive material~~ layer is in a 230 nm to 260 nm range.

10-15. (Cancelled)

16. (Previously Presented) The method for manufacturing a liquid discharge head according to claim 5, wherein [[the]] a first wavelength of light used to expose ~~range for sensitizing~~ the first ~~positive type photosensitive material~~ layer is in a 270 nm to 350 nm range, and [[the]] a second wavelength of light used to expose ~~range for sensitizing~~ the second ~~positive type photosensitive material~~ layer is in a 230 nm to 260 nm range.

17-24. (Cancelled)

25. (New) The method for manufacturing a minute structure according to claim 1, wherein a first wavelength of light used to expose the first layer is in a 270 nm to 350 nm range, and a second wavelength of the light used to expose the second layer is in a 230 nm to 260 nm range.

26. (New) The method for manufacturing a minute structure according to claim 1, wherein, in exposing the part of the second layer, a portion outside of a portion on which a first part of a mold of the second layer is provided is exposed.

27. (New) The method for manufacturing a minute structure according to claim 2, wherein, in exposing the part of the second layer, a portion outside of a portion on which a first part of a mold of the second layer is provided is exposed.